ORTEC®

GammaVision-32 Version 5.2 How-To Guide: Make Gamma-Ray Measurements Today

GammaVision-32 V5.2 is an integrated gamma spectroscopy data acquisition and spectral analysis software program that operates with the ease of the Windows-based operating system environment. By reading in this How-To guide, you will learn the basics of GammaVision and begin making simple gamma-ray measurements. You will need a Standard Source (and the certificate information) for the calibration exercises carried out in the example.

System used for this How-To Guide

GammaVision is a dynamic software package that is capable of recognizing a number of hardware configurations. The software is designed not only to determine the hardware that is connected, but also to enable only those features of GammaVision that are supported by the hardware that you have connected. GammaVision-32 V5.2 can support any mixture of the following types of units (with proper hardware configuration and installation): 916A, 917, 918A, 919, 920, 921, 926, 92X, NOMAD™ Plus, NOMAD, MicroNOMAD®, OCTÊTE PC®, TRUMP®, TRUMP-PCI, MicroACE™, DART®, DSPEC®, DSPEC Plus™, 92X-II, MatchMaker™, M³CA and other modules. The DSPEC Plus Digital Spectrometer was chosen for this How-To Guide due to the increasing popularity of this state-of-the-art product.

Components used for creating this How-To Guide

Item	ORTEC Model No.	Description/Function
GammaVision-32 V5.2	A66-B32	Gamma spectroscopy analysis software
Ge Detector GEM 100%	GEM100	High-resolution gamma-ray detector
Vertical Cryostat	CFG-PV-1	Cooling unit & housing for detector
30 Liter Dewar	DWR-30	Liquid nitrogen (LN_2) holding tank
Lead (Pb) Shielding	NA	Pb bricks with copper liner
Digital Spectrometer	DSPEC-PLUS	Digital spectrometer and MCA (contains HV bias supply for detector and Ethernet Computer interface)
Interface	ETHCBL1 or ETHRJ45	Ethernet connection (10Base2 coax and 10BaseT RJ-45 to coax converter)
Computer	NA	Windows 98, Pentium 233 64MB Memory
Calibration Source	NA	2-L Marinelli Beaker geometry purchased from Analytics, Inc., Atlanta GA
2-L Marinelli Beaker	NA	Model 138-G.Purchased from GA-MA Associates, Miami FL.

Using This How-To Guide

Information in this How-To Guide is restricted to the most relevant tools needed to begin using your system. Calibration basics, theories and fundamentals are touched on only to make clear the purpose of a given task.

There are a number of important steps required for an accurate calibration. By following this How-To Guide, you will familiarize yourself with these steps, and the steps needed to calibrate your system for almost any sample matrix and geometry.

In the example exercise, we highlight the features of GammaVision needed to begin analyzing samples quickly. We assume that your system is powered up and connected to a compatible PC and you have correctly installed the GammaVision software. In the example, we analyze 2-L ground-water samples in a Marinelli-beaker geometry. The sample was collected from a seasonally anoxic lake in the Southeastern United States. Our analyte of interest is Cs-137, with a primary gamma-ray full-energy peak of 661.7 keV. To make these gamma-ray measurements, you will need to accomplish the following tasks:

- Calibrate the detector (energy, efficiency, and peak shape)
- Count your sample
- Analyze the spectrum
- Create a report

To best use this How-To Guide, it is recommended (for the first-time user in particular) that the steps be followed in order from start to finish.

1.0 Calibration

Some things you should know

You need to calibrate your system for three basic parameters:

- Energy vs. Channel Number
- Efficiency
- Full-Width at Half Maximum (peak shape)

Energy vs. Channel Number

When a gamma-ray (photon) is absorbed by a germanium detector, a small signal (often termed a pulse) is produced. The signal is amplified and filtered in such a way as to reduce noise and produce a "clean" signal. The magnitude of the net signal is proportional to the energy of the photon (i.e., photons with greater energies produce larger pulses). A device called an Analog To Digital Converter (ADC) is used to convert each pulse into a channel number (larger pulses will be converted into a higher channel). Each pulse is registered as a count in a unique channel by the Multichannel Analyzer (MCA). The result is a histogram of pulses (called a spectrum) displayed as counts in channels in the MCA emulator window of GammaVision. As pulses are received and processed, GammaVision continuously shows the resulting spectrum. Since the system has no advance knowledge of the energy of the incident photons, an energy calibration is performed to assign the correct energies to appropriate channel numbers. The energy calibration is performed by counting a standard source with known nuclide energies and instructing GammaVision to define channel numbers in terms of known energies. This information is then used to evaluate unknown spectra.

Efficiency Calibration

Only a fraction of the photons emitted from your sample will be registered as counts. This fraction (known as the efficiency) is primarily a function of the energy of the emitted photons, source geometry, size of the detector and sample composition. The efficiency is determined by counting a standard source of the same composition and geometry as your samples. The standard source should consist of a suite of nuclides with energies that will include all nuclides of interest for your measurements. In our example, we will use the auto-calibration feature of GammaVision to calibrate energy and efficiency of the system.

Peak Width Calibration

The width of gamma-ray peaks depends upon a number of statistical uncertainties involved in the processes of collecting and transmitting the gamma-ray signal to the MCA.[1,2] Knowledge of the change in peak width with increasing energy is necessary for measurement of peak area and for peak fitting. By convention, peak width is measured by Full Width at Half Maximum. GammaVision allows the user to calibrate peak width using the same spectrum as energy and efficiency. In this example, the auto-calibration feature is used for peak-width calibration.

Calibration — Getting it Done

1.1 Fit the calibration source on the detector endcap and close the shield. In this example, a 2-L Marinelli beaker standard source was used. The standard matrix is an epoxy with a density of 1.0 g•cm^{-3} (the density of water). The water samples to be analyzed must use this same 2-L Marinelli beaker geometry and be the same density.

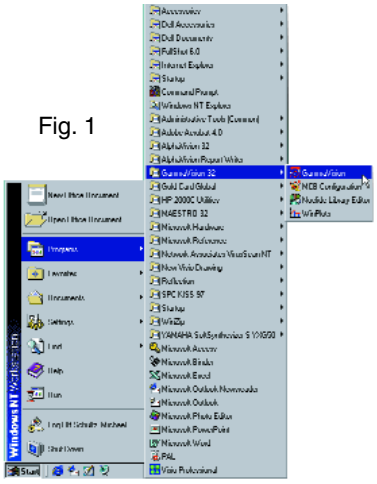

Fig. 1

1.2 From the Windows desktop, click **Start**, **Programs**, **GammaVision-32**, **GammaVision** (Fig. 1). This will invoke the GammaVision software. Your view will be of the Multichannel Analyzer (MCA) emulator window. The MCA emulator window is the main interface for working with GammaVision. There are nine menus to choose from:

- File
- Acquire
- Calibrate
- Calculate
- Analyze
- Library
- Services
- ROI
- Display

Fig. 2

1.3 Choose **Acquire**, **Start** to begin counting your standard source (Fig. 2). Count until there are well-defined peaks visible in the main window. Choose **Acquire**, **Stop**.

1.4 Look at the spectrum you have acquired. To change the display (e.g., fill colors and Region of Interest shading), choose **Display**, **Preferences**, and select one of the options. For this example, we will select the **Fill All** option from the **Preferences** submenu (Fig. 3). The resulting spectrum contrasts the background in this example. Use the thumbnail feature in the upper right corner of the main spectrum window to move from one part of the spectrum to another by left-clicking and dragging the mouse (Fig. 4).

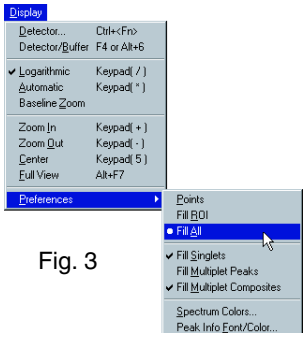

Fig. 3

1.5 Locate a full-energy peak (a clear sharp peak) in the main part of the MCA spectrum and use the **Zoom** feature to look more closely at the structure of the peak. There are three ways to use the **Zoom** feature. First, try the menu approach. Drag the thumbnail until the peak of interest is roughly in the middle of the thumbnail. Click on the peak in the main MCA window. Click **Display**, **Zoom In** to move closer (Fig. 5). Continue to move closer by clicking the **Zoom In** control button on the GammaVision tool bar (Fig. 6). Zoom out from the peak of interest using the same methodology. You can also use the functions **keypad<+>** (to zoom in) and **keypad<–>** (to zoom out). In most cases, the Number Lock on the computer keyboard must be enabled to use the keypad features.

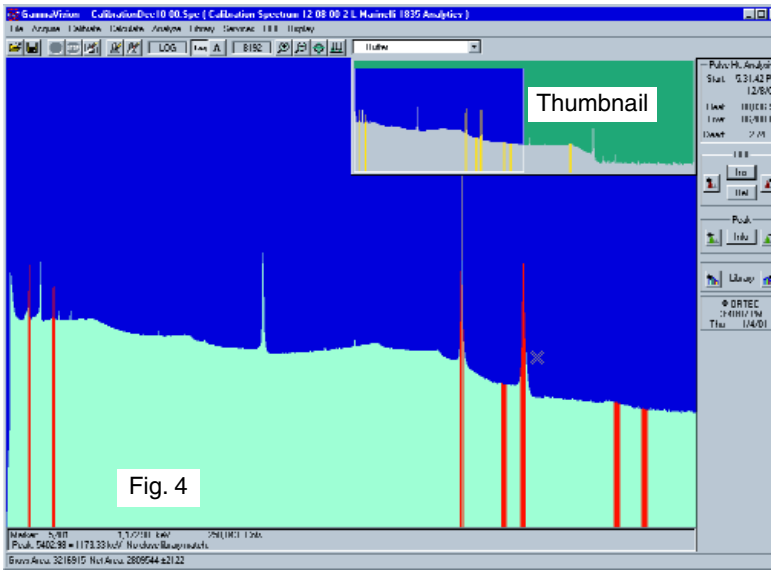

Fig. 4

Note: As mentioned above, an important parameter in accurate gamma-ray measurements is the shape of the full-energy peaks. In order to correctly portray the peak width, the transformation of pulses to counts in the MCA must be optimized. This is accomplished manually by adjusting the pole-zero feature in the system. GammaVision automates this procedure using a computer algorithm located in the **MCB Properties** submenu in the main **Acquire** menu. In this example, a DSPEC Plus digital spectrometer is used.

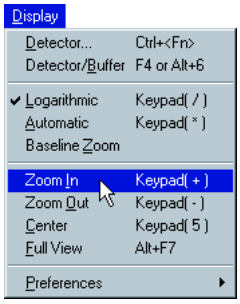

Fig. 5

Fig. 6

1.6 To optimize the shape of the gamma-ray peaks for your system, choose **Acquire**, **MCB Properties**, and click the **Amplifier** tab. Adjust the **Fine Gain** to 0.67 and choose X1 for the **Coarse Gain** (Fig. 7). Click the **Optimize** control. In a few moments the computer algorithm will automatically adjust the pole-zero feature of the DSPEC Plus. You will be alerted when the process is complete.

Note: Inspect closely one of the full-energy peaks by using the **Thumbnail** and **Zoom** In features as described above. A well-shaped gamma-ray peak will be "gaussian" in shape (roughly symmetric about the centroid). The base of the peak will be slightly higher on the low energy side of the peak due to a phenomenon known as Compton Scattering. For a full explanation of this phenomenon, consult the texts in the Reference section of this How-To Guide.

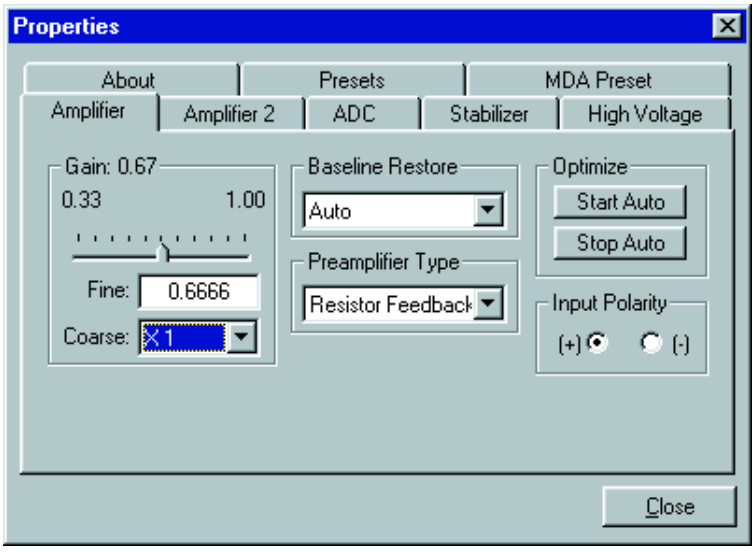

Fig. 7

1.7 The first step in the energy calibration is to collect a spectrum using a standard source consisting of nuclides with known energies. The length of the count will be dependant on the count rate in the peak-energy regions of your standard calibration source and the counting statistics that you would like to achieve. A good rule of thumb for the number of counts in the full-energy peak region (for calibration) is 100,000 (0.3% counting statistics). GammaVision allows you to preset a limit for the count time (real time or live time), peak-centroid counts, or Region Of Interest (ROI) integrated counts.

1.8 To determine the needed count time, choose **Acquire**, **Start**. Count for several minutes, then choose **Acquire**, **Stop**. Here you will use the embedded features of GammaVision to determine the number of net counts in a Region of Interest (ROI). Place the cursor to the left of the peak of interest. Left click and drag the cursor across the energy peak — a box will appear as you drag the cursor (Fig. 8A). Once the box encompasses the entire width of the peak, stop and unclick. The box will remain in the window. Next, right click within the box and select **Mark ROI** (Fig. 8B). The result is a highlighted ROI (Fig. 8C). To view the attributes of the peak, right click within the region and select **Peak Info** (Fig. 9). An information box will appear that contains relevant information about the selected region (Fig. 10). In this example we find that the number of net counts (the area of the peak above the background) for the 1173 keV Co-60 peak is 3,302,351 counts — well in excess of the needed counts for good peak statistics (<0.1% in this case) for an energy calibration. Repeat this exercise for other peaks of interest for your standard source. Scale the count time for your calibration to ensure good statistics for all the certified nuclides in your standard source.

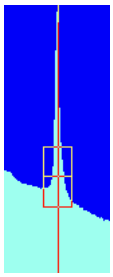

Fig. 8A

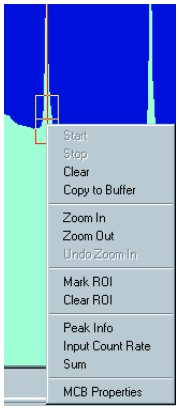

Fig. 8B

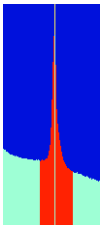

Fig. 8C

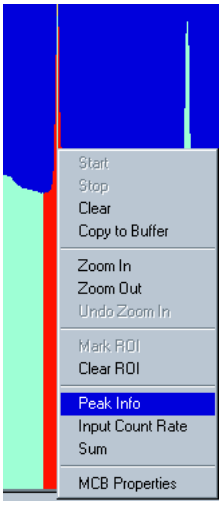

Fig. 9

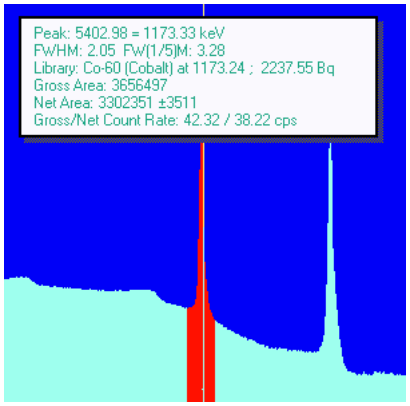
Peak: 5402.98 = 1173.33 keV
FWHM: 2.05 FW(1/5)M: 3.28
Library: Co-60 (Cobalt) at 1173.24 ; 2237.55 Bq
Gross Area: 3656497
Net Area: 3302351 ±3511
Gross/Net Count Rate: 42.32 / 38.22 cps

Fig. 10

1.9 Once you have determined the needed count time for your calibration, you will need to preset a value for the count time. Choose **Acquire**, **MCB Properties**, **Preset Limits**. Click in the **Live Time** input box and type the desired Live Time (in seconds) for your calibration (Fig. 11).

1.10 Choose **Acquire**, **Start** and allow the system to accumulate counts for the preset live time. When the acquisition is complete, choose **File**, **Save** and save the file to an appropriate working directory.

Note: There are three steps to conclude the calibration process: Energy Calibration, Peak Shape Calibration (FWHM), and Efficiency Calibration. Each step involves selection of peaks in the spectrum, input of known peak information, and archiving of the spectra and peak information. You will calibrate the energy first (peak shape is also accomplished with this step). Next, save the energy calibration (.ent file) to the working directory, then calibrate for efficiency and save the efficiency calibration (.eft file). Finally, you will save the spectrum as a .clb file that contains all the calibration information needed to analyze your samples.

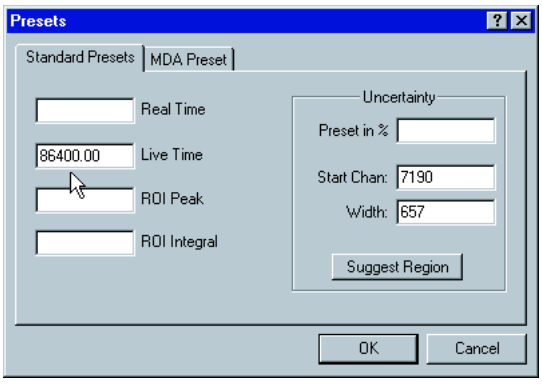

Fig. 11

1.11 Choose **Calibrate**, **Energy** (Fig. 12A). Three new windows will appear — **Energy**, **Energy Table**, and **Calibr**, (Fig. 12B). These windows may be selected and moved by left-clicking and dragging the upper colored part of each window.

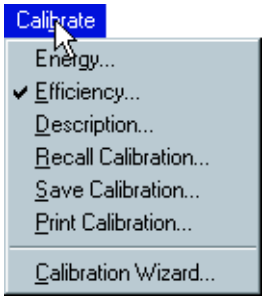

Fig. 12A

1.12 From the **Calibr** window, choose the Windows™ icon in the upper left-hand corner and scroll to **Destroy** (Fig. 13). This will eliminate any existing calibration information.

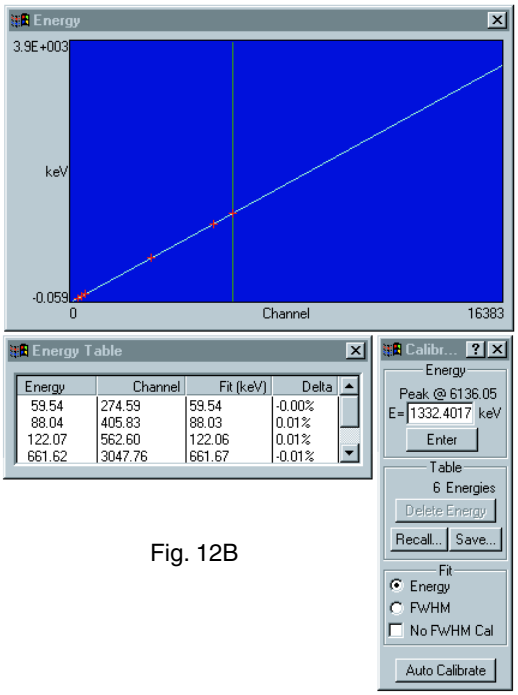

Fig. 12B

Note: GammaVision manages analysis information in the form of libraries. There are a number of libraries that are included with GammaVision. For calibrations, the **Calib** library contains a list of common nuclides included in full spectrum calibration sources.

1.13 Choose **Library**, **Select File** (Fig. 14A). The **Calib** library resides in the **User** directory (by default). If you have moved the **Calib** library, browse to the correct directory. Select the **Calib** library and click **Open** to load this library (Fig. 14B).

1.14 Choose **Library**, **Edit**, **GammaVision Editor** (Fig. 15). A window appears containing the nuclides included in this library (and the peak information for each peak).

1.15 Compare the list in the **Calib** library to the list of nuclides contained in the Standard Certificate for your standard source. You may delete nuclides from the list by highlighting the nuclide and selecting **Cut** (Fig. 16).

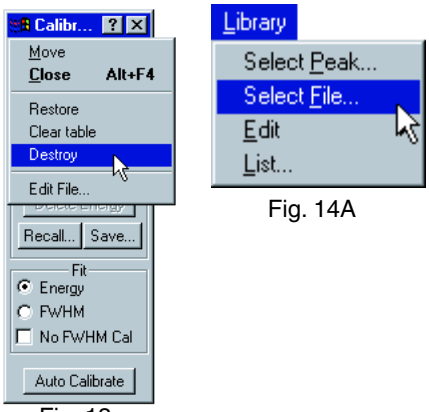

Fig. 13

Fig. 14A

Fig. 14B

Fig. 15

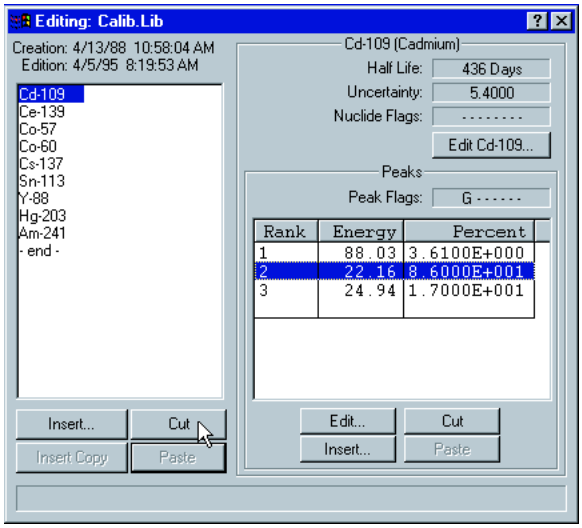

Fig. 16

1.16 To add a nuclide to the list, click **Insert**. Input the **Nuclide Name**, **Half Life**, and **Uncertainty** information (from the standard certificate) and click **OK** (Fig. 17). The check boxes in this window are designed to flag nuclides of your choice for reporting purposes. We'll skip this for now.

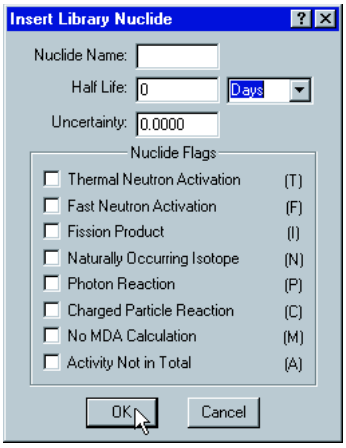

Fig. 17

1.17 Choose **Auto Calibrate** in the **Calibr** window to calibrate energy and FWHM (Fig. 18A). The energy calibration table and a graphical representation of the fit will appear. The energy vs. channel fit should appear linear (Fig. 18B). If not, return to step 1.14 and carefully compare the list of nuclides in the library to the list of nuclides on your standard certificate — the energies must match. Another way to check the energy calibration is to inspect the Delta values in the Energy Table (Fig. 18C). These values are a measure of how well the calibration fits the actual data points. For a well-shielded system, the Delta values for a good energy calibration should be small — typically less than 1%.

1.18 Inspect the **FWHM** calibration by selecting **FWHM** in the **Calibr** window. The table and graph will immediately display (Fig. 19). The trend for the FWHM is increasing with energy — although non-linear.

Fig. 18A

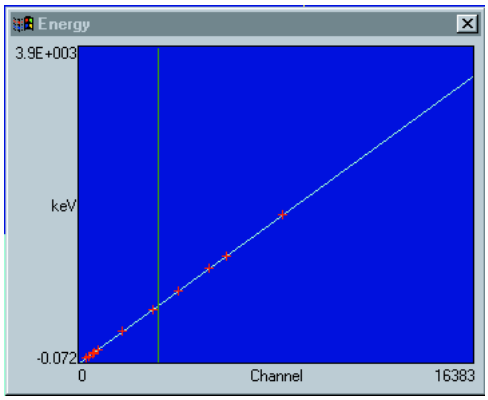

Fig. 18B

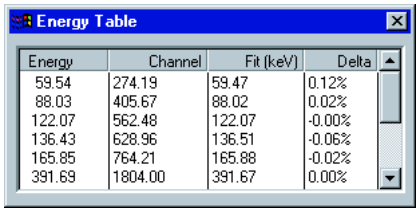

Fig. 18C

1.19 Save the energy calibration by choosing **Save** in the **Calibr** window. Browse to the directory where you would like to store the energy calibration, name the file (a representative name is recommended), and click **Save** (Fig. 20). Click the **"X"** in the upper right-hand corner of the **Calibr** window to exit the efficiency calibration workspace. The working energy calibration is now the file that you just saved — this includes FWHM and energy vs. channel number.

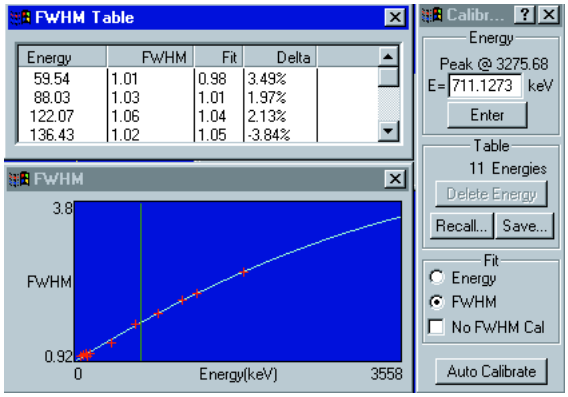

Fig. 19

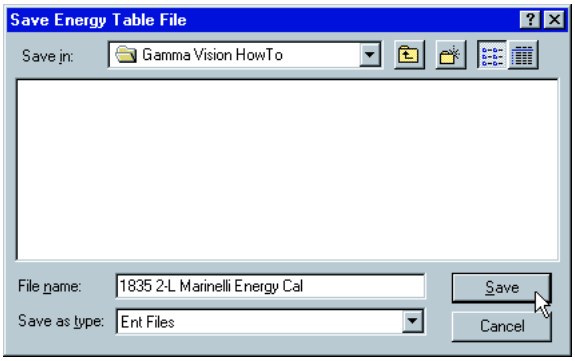

Fig. 20

1.20 To begin the Efficiency Calibration, choose **Calibrate**, **Efficiency** (Fig. 21). Next, click the Windows icon in the upper left-hand corner of the **Calibr** window and select **Destroy** (Fig. 22). This will eliminate any existing efficiency calibration information — the energy and peak width calibration will remain intact.

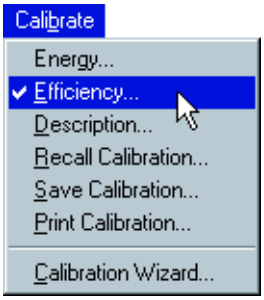

Fig. 21

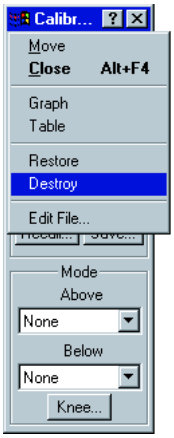

Fig. 22

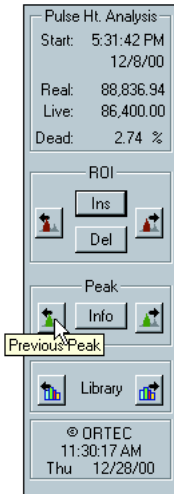

Fig. 23

Note: In the next section, you will manually build an efficiency library and calibrate your system for efficiency vs. energy. In Steps 1.21 and 1.22 you will insert the peaks that you wish to include. **For this procedure, be sure to insert the peaks beginning with the lowest up to the highest energy.**

1.21 Begin selecting the nuclides for the efficiency calibration beginning with the lowest energy peak in your nuclide list. In this example, Am-241 is the lowest energy nuclide in the 2-L Marinelli standard source. Move to the Am-241 peak by using the Peak selection tool on the right-hand sidebar of the MCA window (Fig. 23). Check the energy of each peak by clicking **Peak Info** (as in Step 1.8) or by viewing the status line at the bottom of the MCA window.

Fig. 24A

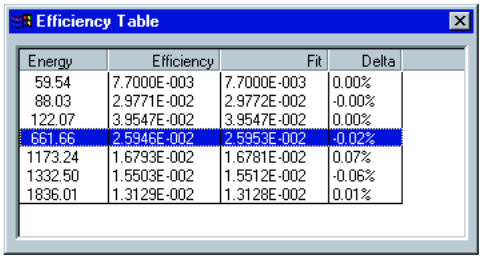

Fig. 24B

1.22 Follow the following procedure for each peak selected: Choose **Enter** from the **Calibr** window (Fig. 24A) — an entry will appear in the Efficiency Table. *Select the entry in the table then click* **Calc** *from the* **Calibr** *window* (Fig. 24B) — the Efficiency Calculation Worksheet window will appear (Fig. 24C). Complete the form using the information from your Standard Certificate and click **Calculate Efficiency**. When you have completed the form and the efficiency has been calculated, click **OK** to return to the MCA window.

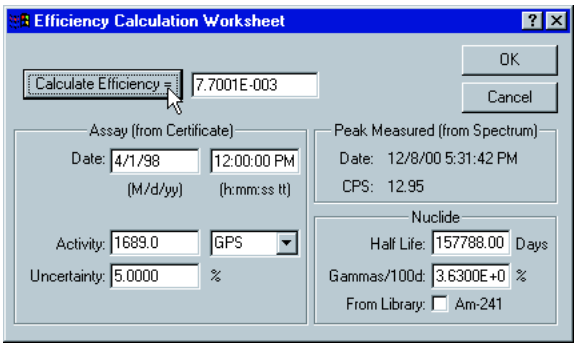

Fig. 24C

Fig. 25A

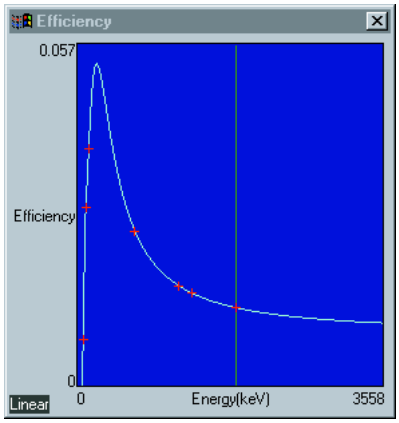

Fig. 25B

1.23 Repeat this procedure for each nuclide in your standard source that you wish to include in the efficiency calibration. **Be sure to insert the peaks in ascending order by energy.**

1.24 Once you have selected the peaks for your efficiency calibration, choose **Polynomial** from the **Mode** list in the **Calibr** window (Fig. 25A). The resulting fit should look similar to the one obtained in this example (Fig. 25B).

1.25 To save the efficiency calibration, click **Save** in the **Calibr** window, browse to the working directory, name the file, and click **Save** (Fig. 26).

1.26 Once the efficiency table file has been saved, exit the calibration by clicking the **"X"** in the upper right-hand corner of the **Calibr** window.

1.27 Next, save the complete calibration as a ".clb" file that can be recalled at any time for analyzing samples of this geometry and matrix (2-L water samples in the Model 138 Marinelli beaker geometry, see Step 1.1).

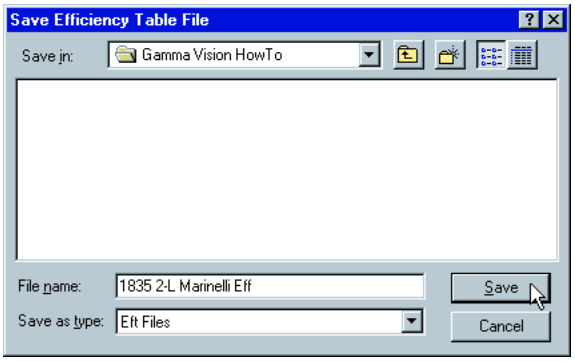

Fig. 26

1.28 Choose **Calibrate**, **Save Calibration** (Fig. 27A). Browse to the working directory, name the file (a representative name is recommended) and click **Save** (Fig. 27B). A dialog box will appear to allow you to input a detailed description of the calibration (Fig. 27C). Input the description and click **OK**.

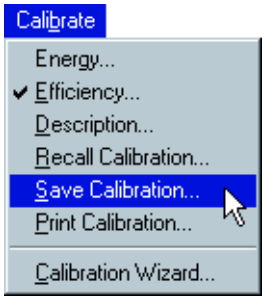

Fig. 27A

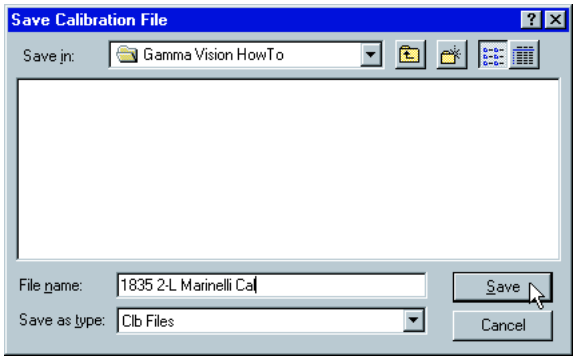

Fig. 27B

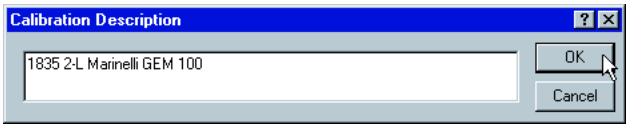

Fig. 27C

2.0 Sample Type Setup — Libraries and Analysis Options

Note: GammaVision is designed with the flexibility to create many custom application analyses. The software includes four analysis algorithms — each with a unique capability. For this How-To Guide, we will use the WAN32 analysis program. For a description of the analysis programs included in GammaVision, please consult the GammaVision-32 V5.2 User's Manual.

GammaVision assembles the important parameters of gamma-ray analysis in one convenient Windows dialog environment called the **Sample Type** — in most cases a template is needed to allow the Operator to create one analysis for many samples. The parameters that often require customization include:

- Calibration
- Peak Library Data
- Report Output Requirements
- Decay Corrections
- Method of Peak Analysis

We will use the Sample Type environment to create a template to analyze 2-L water samples. These samples were collected (at varying depths, 0 to 9 m) from the water column of a small lake in the Southeastern United States.

2.1 To begin, create a library which includes only the nuclides that we are interested in reporting for our analysis. From the main MCA window in GammaVision choose **Library**, **Select File** (Fig. 28A).

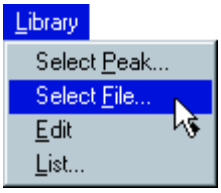

Fig. 28A

2.2 Browse to the User directory, choose the **Calib** library and click **Open** (Fig. 28B).

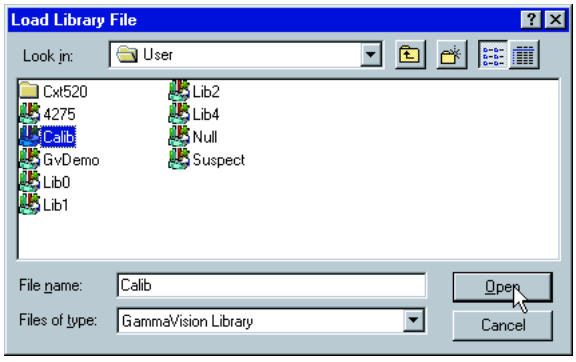

Fig. 28B

2.3 Choose **Library**, **Edit**, **GammaVision Editor** (Fig. 28C).

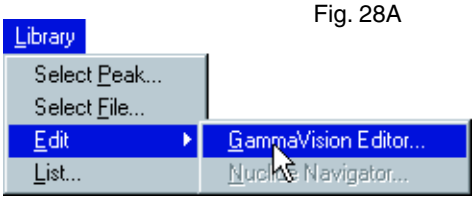

Fig. 28C

2.4 Since we are interested in Cs-137 and a few other naturally-occurring radionuclides, we may delete several of the isotopes used for calibration. Save this library with a new name that represents the type analysis it will be used for. Click the **Windows icon** in the upper left-hand corner of the editor and choose **Save Library As** (Fig. 29). Save the library with a representative name — in this example we call the library "PondB".

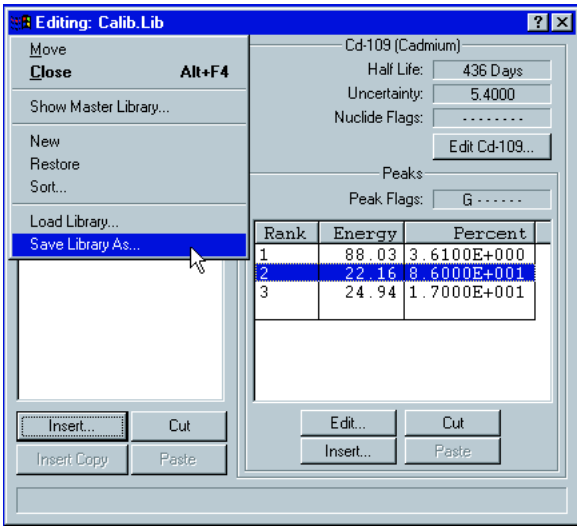

Fig. 29

2.5 To delete isotopes from the library highlight the isotope in the list (with a single click) and choose **Cut** (Fig. 30). Delete all of the isotopes in the library list except Cs-137 and Am-241.

2.6 To add nuclides to the library list, click the **Windows icon** in the upper left-hand corner of the editor and select **Show Master Library** (Fig. 31). Choose the **Suspect** library list from the User directory and click **Open** (Fig. 32).

2.7 We will add Ra-226 and Th-234 to the library. Highlight Ra-226 from the Suspect list (with a single click). Next, click **Insert Ra-226** in the PondB Editor Window (Fig. 33). Repeat this exercise for Th-234. Close the Suspect list by clicking the **"X"** in the upper right-hand corner of the window. Close the PondB library in the same way. You will be prompted that the library has been changed and asked to save the changes — answer yes to these questions and you will return to the MCA window.

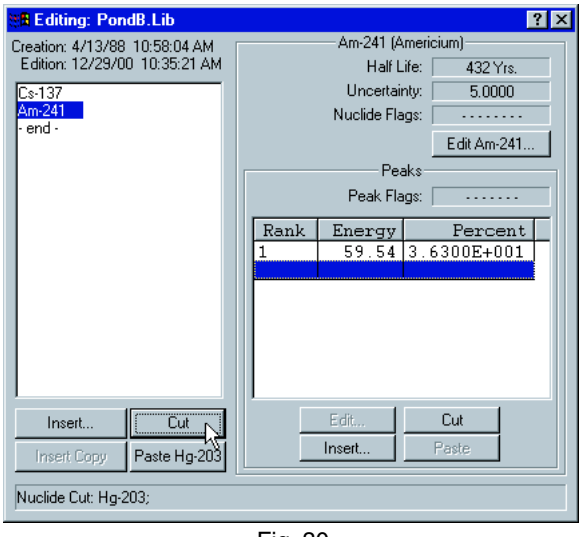

Fig. 30

Note: You have now completed the steps necessary to calibrate your system for three basic parameters:

- Energy vs. Channel Number
- Peak Shape (FWHM)
- Efficiency vs. Energy

Now, to create a template that can be applied to many samples. We will apply the template to the analysis all samples in this group.

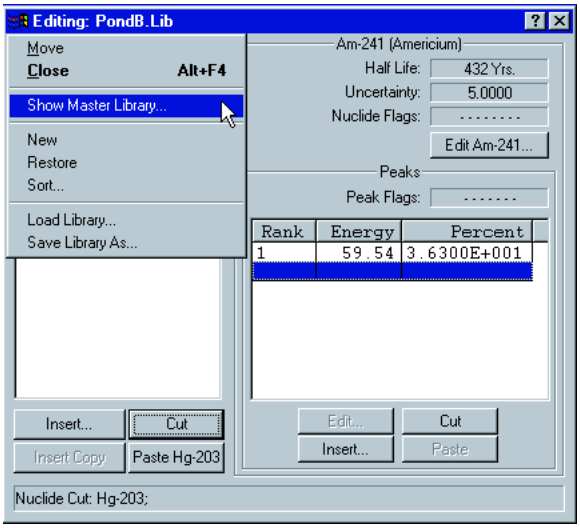

Fig. 31

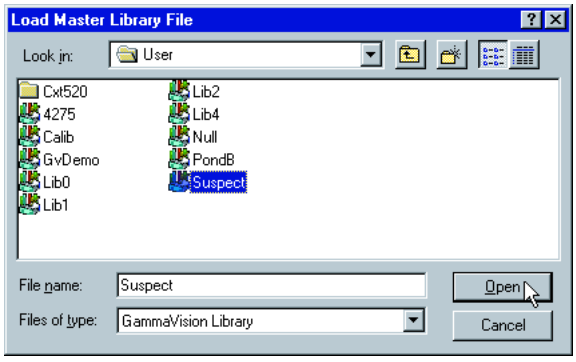

Fig. 32

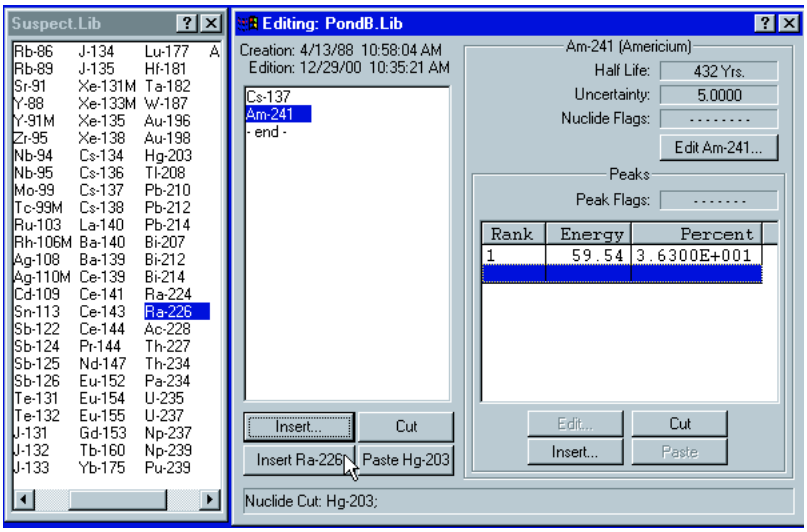

Fig. 33

2.8 Choose **Analyze**, **Settings**, **Sample Type** (Fig. 34A) to open the Analysis Options dialog window (Fig. 34B).

2.9 Select the **Sample** tab. We are creating a template to use for many samples — we will save this template as an ".sdf" file that can be applied to all our analyses. Click **Save As** from the **Sample** tab, browse to the working directory, name the file and click **Save** (Fig. 35).

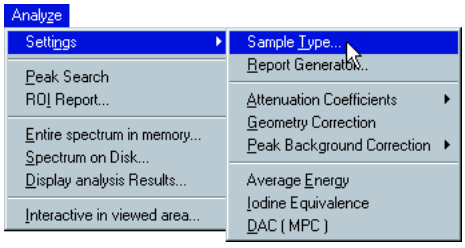

Fig. 34A

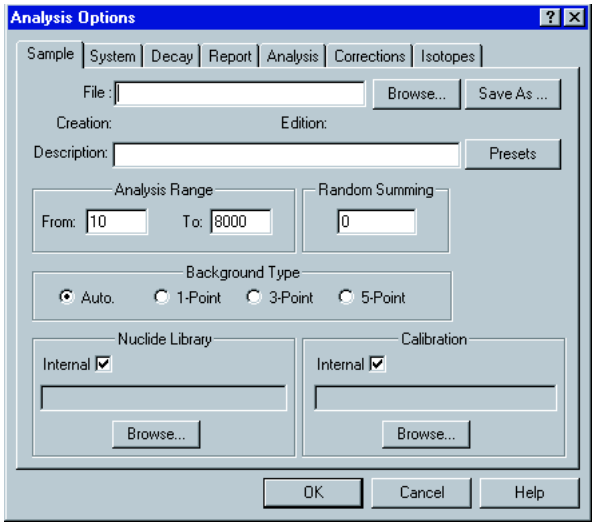

Fig. 34B

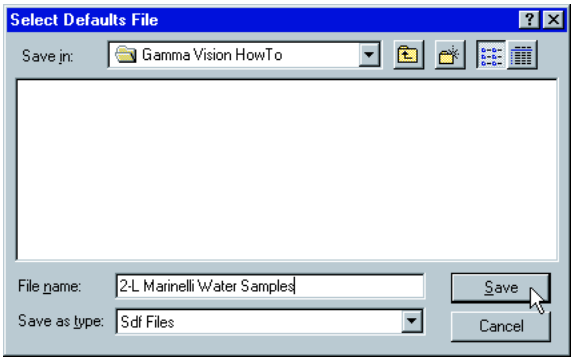

Fig. 35

2.10 Complete the **Sample** tab by performing the following (Fig 36 can be used as a guide):

• Click **Presets** and place the cursor in the **Live Time** input box and type the number of seconds for your count — for this example input 86,400 seconds (a one-day count). Click **OK** and type in a description for your ample counts.

• Type in an **Analysis Range From**:200 **To**:16,000 and set **Random Summing** to 0.

• Select the **Auto Background Type**.

• Click **Browse** to select the **Nuclide Library** that you created in Steps 2.1 to 2.7.

• Click **Browse** to select the **Calibration** that you saved in Step 1.28.

• Uncheck the **Internal** check boxes for **Nuclide Library** and **Calibration**.

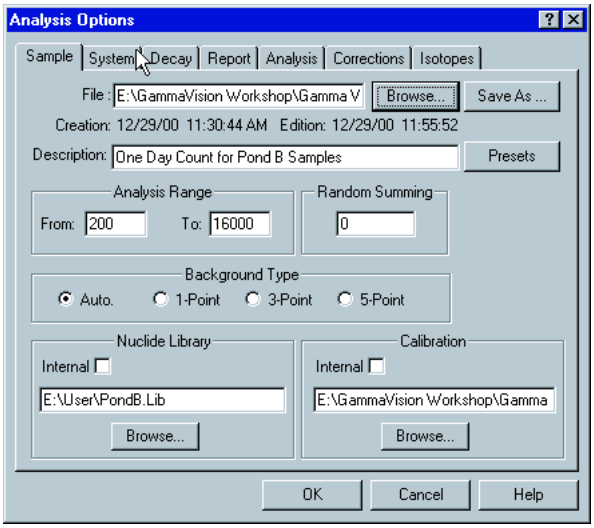

Fig. 36

2.11 Click the **System** tab and perform the following (Fig. 37 can be used as a guide):

• Fill in the **Laboratory** and **Operator name** fields.

• Choose the Traditional ORTEC **MDA Type**.

• Set **Peak Search Sensitivity** to "3".

• Complete the rest of the form as shown in Figure 37.

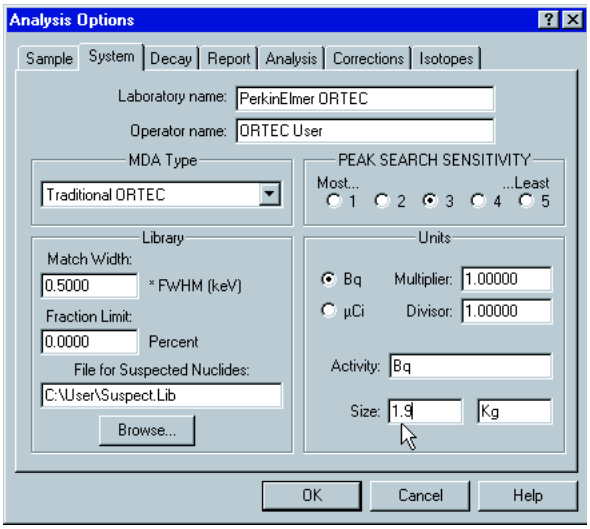

Fig. 37

2.12 Click the **Decay** tab and complete the form as follows (Fig. 38 can be used as a guide):

• Check the **Decay Correction Collection** checkbox (this decay corrects to the sampling date)

• Fill in a **Date** and **Time**.

Note: The **During Acquisition** checkbox decay corrects the sample for decay during counting. GammaVision also allows the user to decay correct during sampling (the Collection check box under Sample Collection). Since our analyte is Cs-137 (t1/2 = 30.2 years), the corrections for our example are negligible — the sample was collected over a 30 minute time period and count time is about one day (much less than the 30-year half-life).

2.13 Click the **Report** tab (Fig. 39).

• Uncheck the four **Reporting Options** checkboxes.

• Choose **Percent** and **Total** under **Uncertainty Reporting** and **2-Sigma** under **Confidence level** to report a 2-sigma confidence level uncertainty as a percent of the activity concentration (you may also choose to report uncertainties in activity units).

• Under **Output**, check **Display Analysis Results** and choose **Program**. You must choose a text editor to display the results. In this example, we have chosen NOTEPAD.EXE. Choosing these options invokes the NOTEPAD text editor and displays the report when an analysis is performed.

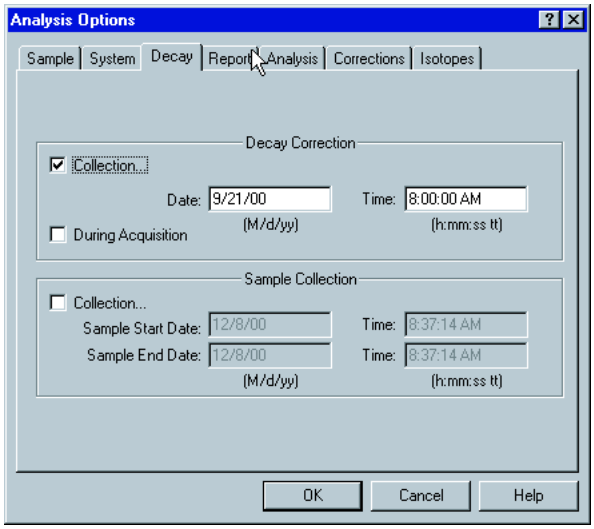

Fig. 38

Note: GammaVision has the ability to create numerous custom reports. The settings chosen here will generate a simple report for illustration. For more detailed reports, please consult the GammaVision-32 V5.2 manual.

2.14 Click the **Analysis** tab to choose an Analysis Method and additional uncertainty components.

• Choose the **WAN32** Program under **Analysis Method**.

• Add any additional uncertainty components under **Additional Error** — in the example, we determined that the volumetric measurements of our samples contributed a 2% uncertainty component to the total uncertainty. You may add a **Random** component in the **Additional Error**.

• Complete the rest of the form as shown in Figure 40.

Note: There are four analysis engines included in GammaVision. Although these analysis engines incorporate the same fundamental constants and decay equations, each program treats the sample analysis differently. The WAN32 analysis program is a good choice for simple analyses with a relatively small number of nuclides. For a more detailed description of the GammaVision analysis engines, consult the GammaVision-32 V5.2 User's Manual.

2.15 The **Corrections** and **Isotopes** tabs will not be needed for this analysis — the check boxes should be left unchecked.

2.16 Since each sample is a slightly different volume (not necessarily the same as the standard source), the sample volume must be input. This may be accomplished by using the **Ask On Start** or **Ask On Save Options**.

2.17 To instruct GammaVision to ask for the **Sample Volume** when the user **Saves** the spectrum — such as at the end of the acquisition, choose **File**, **Settings** (Fig. 41) and check the **Sample Size** checkbox under **Ask On Save Options** (Fig. 42). This will ensure that a value is input for this parameter for every sample and allow the user to create a template useful for many samples.

Uncheck the Sample Size for now — we will use the Ask On Start Option in Step 3 instead.

2.18 Check **Integer.Spc** under **Save File Format**. The Integer.Spc format should be used in most cases. Consult the GammaVision-32 V5.2 User's Manual for a description of the file formats included in GammaVision software.

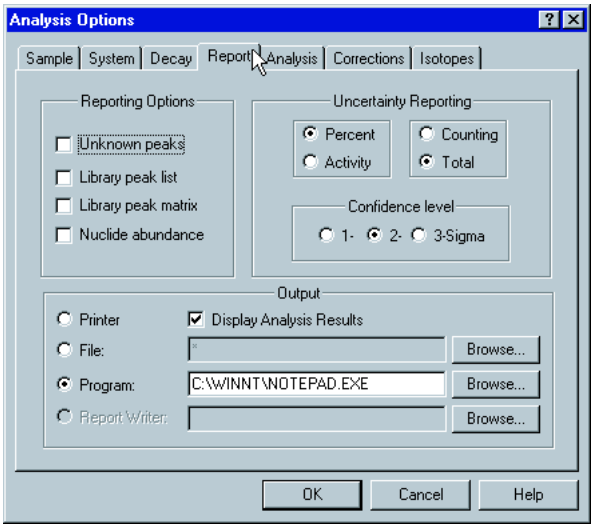

Fig. 39

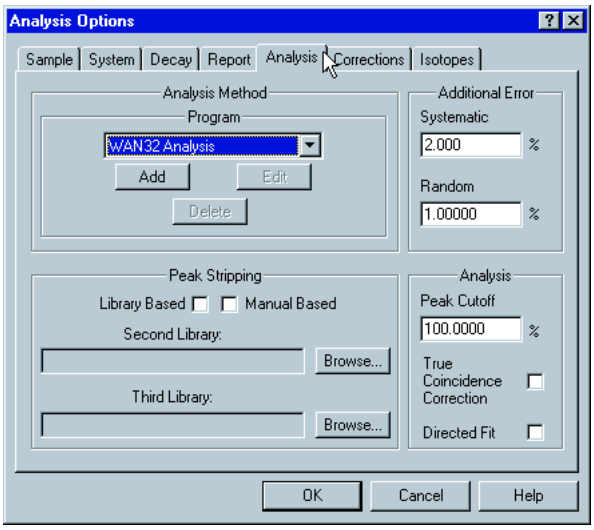

Fig. 40

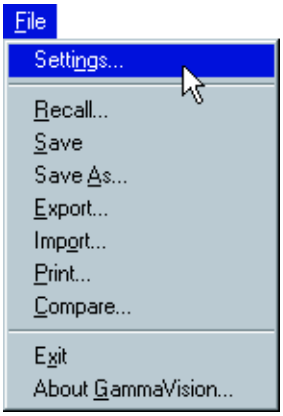

Fig. 41

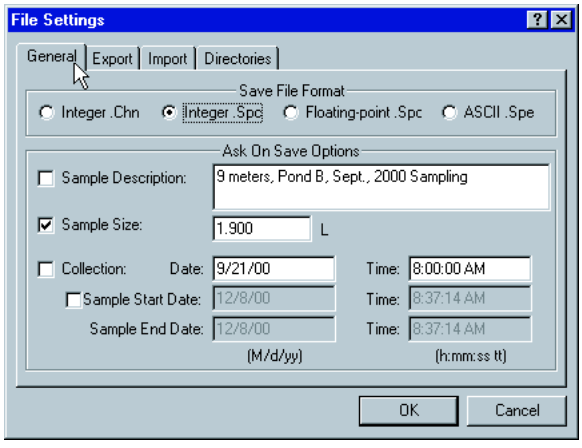

Fig. 42

3.0 Sample Analysis and Reporting: Acquiring, Saving, and a Simple Report

Note: When GammaVision performs an analysis, a number of reports are generated — some user driven, some automatic. The default settings for archiving these reports is located (from the main MCA window) under **File**, **Settings** — choose **Directories** to inspect the defaults (Fig. 43). To modify these settings, choose **Modify** from the **Directories** tab and browse to the directory of your choice.

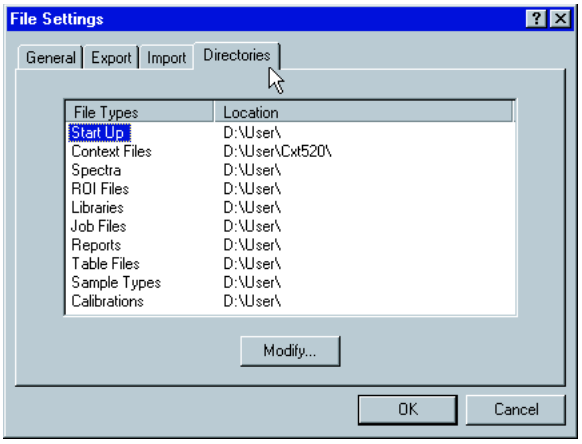

Fig. 43

For our example, we chose to display the reports, but not to archive the reports (Step 2.13) — we could have easily chosen to create a report, display it for review, and archive the report in a user-defined directory in Step 2.13.

3.1 Fit your sample on the detector in the same manner as the standard source used for calibration. In this example, we are analyzing six water samples for Cs-137. The sample analysis and reporting characteristics that are common to all of the samples are included in the **Sample Definition File** (.sdf) created in Step 2. The Live Time Preset was set in Step 1.9 (**Acquire**, **MCB Properties**). Next, we will set up an automated dialog that will guide the user through input of the parameters that are unique to the individual samples in this group. These characteristics include:

- Sample Description
- Sample Size

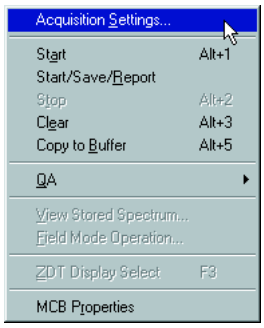

Fig. 44

3.2 To setup the user dialog for input of these unique sample parameters, choose **Acquisition Settings** (Fig. 44). If the Sample Definition File created in Step 2 is not selected in the input box, browse to the file location and choose open. Place a checkmark in the boxes for **Sample Description** and **Sample Size** and click **OK** (Fig. 45).

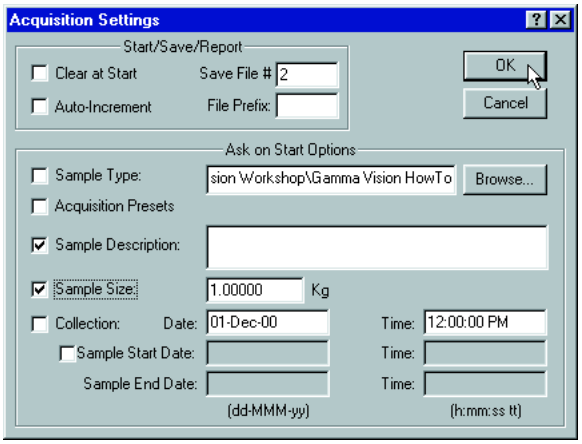

Fig. 45

3.3 Select **Acquire**, **Start**. Dialog boxes will appear, which require user input for sample information prior to the start of the acquisition (Fig. 46A, B). Input the information for each dialog box and click **OK.** The information is now stored with the spectrum for analysis. Once the input parameters are complete, the count will begin.

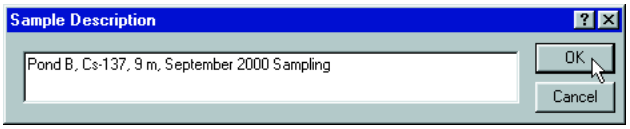

Fig. 46A

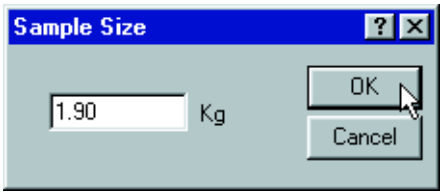

Fig. 46B

3.4 Upon completion of the count, choose **Analyze**, **Entire Spectrum in Memory** (Fig. 47). The Sample Definition File stored all analysis option parameters that were created in Step 2. A report will be generated on the screen — this action will invoke the Notepad software to create the report that was setup in Step 2.13 (Fig. 39).

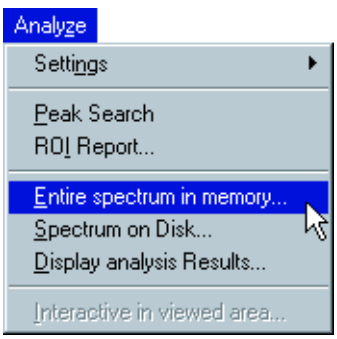

Fig. 47

3.5 The report contains all relevant data and information about the calibration, collection date and time, spectral analysis program, and a summary of the activities of the nuclides in the PondB library that was created in Step 2 (Fig. 48A, B, C).

```
Sample description
     9 meters, Pond B, Sept., 2000 Sampling


Spectrum Filename: D:\GammaVision Workshop\Ron's Machine\Sept2000Samp
                   ling\PondB9m.An1

Acquisition information
       Start time:                 08-Dec-2000 08:37:14
       Live time:              86400
       Real time:              86498
       Dead time:                  0.11 %
       Detector ID:                   1
```

Fig. 48A

```
Calibration
       Filename:                   PondB9m.An1
     1835 2-L Marinelli GEM 100


       Energy Calibration
            Created:               07-Dec-2000 16:50:34
            Zero offset:          -0.059 keV
            Gain:                  0.217 keV/channel
            Quadratic:             2.235E-08 keV/channel^2

       Efficiency Calibration
            Created:               10-Dec-2000 10:29:37
            Type:                  Polynomial
            Uncertainty:           1.063 %
            Coefficients:         -0.728344  -3.254841   0.048199
```

Fig. 48B

```
*****   S U M M A R Y   O F   N U C L I D E S   I N   S A M P L E   *****
         Time of Count  Time Corrected  Uncertainty  2 Sigma
Nuclide     Activity       Activity       Counting     Total
               Bq/L           Bq/L

CS-137       7.0856E-01    7.1205E-01   5.6915E+00%   6.6178E+00%
RA-226       3.6491E+00    3.6495E+00   3.2259E+01%   3.2555E+01%
TH-234       7.7990E+00    7.3561E+01   2.4337E+01%   2.4697E+01%
AM-241  <    1.0908E-01    1.0911E-01
  < - MDA value printed.
  A - Activity printed, but activity < MDA.
  B - Activity < MDA and failed test.
  C - Area < Critical level.
  F - Failed fraction or key line test.
  H - Halflife limit exceeded
```

Fig. 48C

Figure 48. Excerpts of information included in the report that was created in Step 2. The report contains Sample Identification information (Fig. 48A), calibration data (Fig. 48B), and a summary of the activity concentration of the nuclides of interest (Fig. 48C).

Congratulations! By following this How-To Guide, you have completed a number of the steps needed to make gamma-ray measurements using GammaVision-32 V5.2. You have also familiarized yourself with a number of the important features and tools that will make implementing GammaVision for your application simpler and faster.

Reference

(1) Gilmore, G. & Hemingway, J. D. (1995), Practical Gamma-Ray Spectrometry, John Wiley and Sons, NY, NY.

(2) Knoll, G. F. (1989), Radiation Detection and Measurement, Second Edition, John Wiley and Sons, NY, NY.

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